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ABSTRACT

A project developed and field tested a Student Assessment System (SAS) to aid in the articulation of secondary and postsecondary vocational programs in Georgia. A systematic procedure was provided for determining credit toward advanced placement for secondary vocational students entering a related postsecondary program and for advanced placement of students who have gained experience in the armed services or through on-the-job training. Steps in the SAS included (1) Student investigates postsecondary programs: (2) career decision made: (3) formal application with request for regular entry or advanced placement: (4) if student requests advanced placement, then assessment level decision made: (5) advanced placement based on desk top review, structured interview, domain referenced testing, or comprehensive testing: and (6) student begins training at level reflecting previous training. Assessment instruments for determining advanced placement were developed by an examination of a sample of competencies within the occupational field, through either a structured interview or sampling test. The Student Performance Record was designed as a record listing competencies acquired by the student in a prior training project. Domain referenced tests were developed to document student competency in skill areas not verified through structured interviews. (YLB)

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STUDENT ASSESSMENT SYSTEM

Developed Under Contractual Agreement with

Division of Program Development
Office of Vocational Education
Georgia Department of Education
Atlanta, Georgia 30334
Charles McDaniel, State Superintendent of Schools
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OVERVIEW

Introduction

The purpose of this project was to develop and field test a student assessment system to aid in the articulation of secondary and post secondary vocational programs in the state of Georgia. The system, as presented, provides a systematic procedure for determining credit toward advanced placement for secondary vocational students entering a related post-secondary vocational program. In addition, it allows for the advanced placement of students who have gained experience in the armed services or through on-the-job training.

The Office of Vocational Education, Georgia Department of Education, has identified a need for a comprehensive plan for the articulation of programs and services between secondary and post-secondary education. A major effort will be directed toward the improvement of articulation during the next several years and the result is expected to be improved utilization of educational resources, significantly reduced duplication of effort, and improved mobility of students, both within and between educational levels. The primary focus is that of providing additional opportunities for horizontal and/or vertical mobility for the student.

The Student Assessment System provides a vehicle for vocational educators to determine the competencies acquired by the student in any learning environment. The system is capable of identifying both the scope and performance level of acquired vocational skills and is based on both the recentness and relevance of those skills.

As an integral part of the system a Student Performance Record was developed which should be the common communications medium for both employers and advanced placement purposes. In addition, the system has

provisions for credit both by waiver and examination which requires a minimum of student and vocational personnel involvement.

Project Products

There were five primary categories of products produced by this project. These products are presented here in summary. The reader is referred to the actual documents for further review and to see the relationship among the documents.

(1) Tests - Tests for the assessment of performance and knowledge were prepared in the areas of Automotive Mechanics, Health Occupations, and Cosmetology. The performance tests consist of a sampling technique (Domain Referenced Tests) which covers all the possible performance situations. These same performance tests, when used in total, may also serve as a comprehensive test. Two of the three skill areas, auto-mechanics and health occupations, also have written tests to accompany the skill test. For cosmetology, only performance tests were developed and teachers are referred to the State of Georgia Cosmetology Licensing Board's recommended study questions for written test items.

(2) Student Performance Record - The Student Performance Records outline, in a task format, the competencies which may be acquired by students at the secondary level. They were prepared in four occupational areas: Health, Auto-Mechanics, Cosmetology, and Electro-Mechanics/Refrigeration, Heating and Air Conditioning. These performance records list, in an abbreviated and coded format, all of the tasks, duties, and major areas in each occupational area. In order to interpret the record, a supporting document, Task Detailing, is provided which lists the tasks and gives the learning steps needed to accomplish each task.

(3) Competency Verification Guide - This document was written from a generic point of view and may be used by educational personnel in develop-

ing Student Performance Records, Domain Referenced Tests, and other procedures necessary to verify a student's competency.

(4) Admissions Guide - This document was designed primarily for the post-secondary Student Personnel Worker. It outlines the assessment system and the path a student must follow to receive advanced placement.

(5) Reports - As a culminating activity, the project has prepared this Executive Summary Report which describes the design and operation of the Student Assessment System, and a Final Report containing sections on (a) Rationale, (b) Objectives, (c) Methodology, (d) Findings, (e) Conclusions and (f) Recommendations.

Although most of the material presented in this document is in a summary form, the following section is presented in detail. The Student Assessment System is the central feature of this project, around which all other components are built. Due to the importance of the section describing the system, it was felt that presenting only a summary would do an injustice to the report.

STUDENT ASSESSMENT SYSTEM

A graphic representation of the Student Assessment System is presented in Figure 1. The design of this graphic will be described in detail to give the reader an overview of the operation of the Student Assessment System. The model for the Student Assessment System is based on data collected at meetings with educational leadership personnel from Georgia, literature reviews, contact with consultants from other states with successful articulation systems, and requirements and specifications from the Georgia Department of Education. It is believed that these data-gathering activities have produced a workable, easy-to-manage system which will place students in post secondary programs at a level reflecting prior training. As a result, teachers, students, schools, and the tax-payers of Georgia will benefit from this elimination of overlapping and repetitious training.

THE STUDENT ASSESSMENT SYSTEM

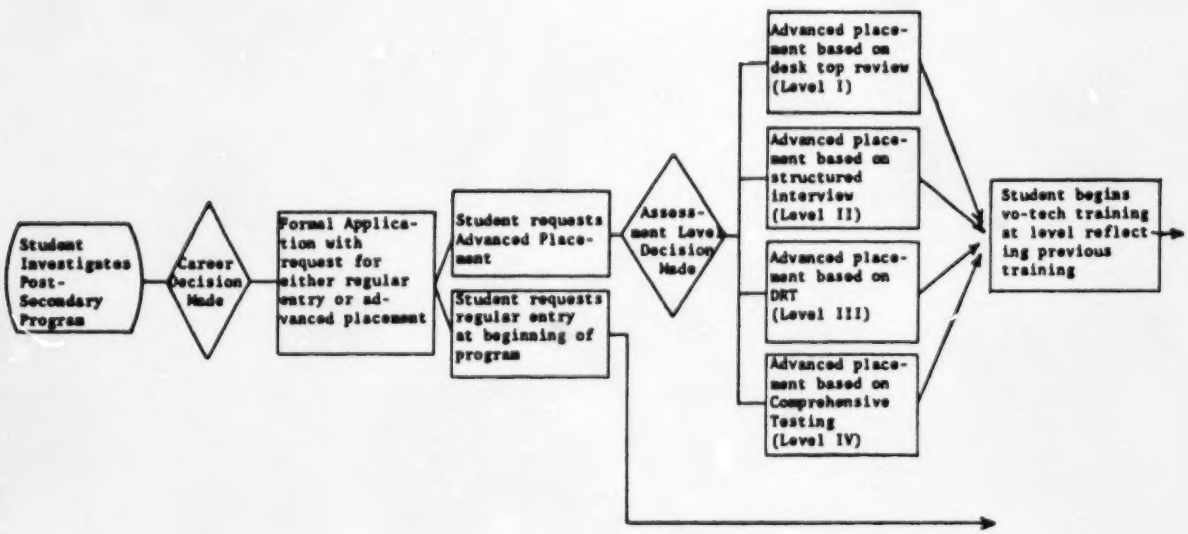
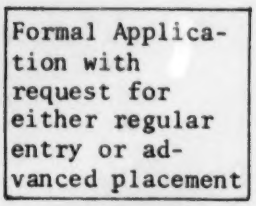

Student Investigates Post-Secondary Program
Career Decision Made
Formal Application with request for either regular entry or advanced placement
Student requests Advanced Placement
Student requests regular entry at beginning of program
Assessment Level Decision Made
Advanced placement based on desk top review (Level I)
Advanced placement based on structured interview (Level II)
Advanced placement based on DRT (Level III)
Advanced placement based on Comprehensive Testing (Level IV)
Student begins vo-tech training at level reflecting previous training

Figure 1

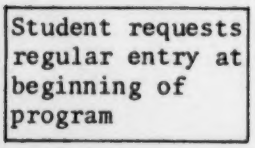
The Student Assessment Model

The potential post secondary vocational-technical student must make an initial decision to investigate advanced training possibilities at the post secondary school.

After a self-examination and conferences with others who are in the position of providing information, the student may make a career decision. This decision can have long range effects on the future of the student; therefore, it should be made with greatest care.

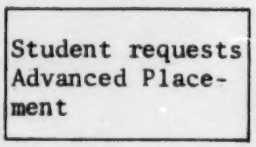


After the career decision has been made to seek further education in a specific vocational-technical area, the student must make formal application. SPS officers in the post secondary school should advise the student as to the proper procedure to enroll and the steps to take in applying for advanced placement.



It is expected that most students entering a post secondary vocational-technical school will request entry at the beginning of the instructional sequence.

The admissions procedure normally requires a battery of tests, transcripts, biographical data, and a formal application. It is suggested that the application blank normally used be altered to accommodate information concerning advanced placement.



At this point, the student, if advanced placement has been requested, must have presented or be in the process of presenting, credentials indicating prior training.

The SPS worker plays the key role in making sure an unqualified student is not subjected to a decision concerning advanced placement. These students should be placed, as a matter of routine, at the beginning of a regular program. Students who appear to be qualified for possible advanced placement will have provided documentation of prior training in the previous admissions process.

Just as the student personnel worker cannot be expected to be a content expert in all vocational-technical areas, the classroom instructors cannot be expected to have expertise in the student personnel services area. Therefore, the two must work together, with assistance from an instructional coordinator, to arrive at a decision point concerning the proper level of assessment for the prospective student. An admissions committee will be formed when these three individuals meet to make an assessment level decision.

Advanced placement based on desk top review (Level I)

If the student's performance record is complete, adequate, well documented, from within a reasonable time limit and not from a questionable source, advanced placement may be made based on documentation of previously acquired knowledge and skills. The above stated criteria are of necessity somewhat less than concrete. Each case should be handled on an individual basis and may require special consideration in some circumstances.

Advanced placement based on structured interview (Level II)

When the documentation of previously acquired skills is questionable or when the time lapse is unacceptable for an automatic waiver, a structured interview (oral examination) may be required. The SPS worker upon noting this (possibly questionable documentation) should alert the admissions committee who will then request assistance from an instructor in the program area to which the student has requested admission.

Advanced placement based on DRT (Level III)

The admissions committee may decide upon reviewing the credentials of a student that the documentation is too poor to grant advanced placement by waiver in either Level I (desk top review) or Level II (structured interview). In this case the student will be placed into the examination mode.

Advanced placement at Level III will be made by an examination based on sampling of competencies within the occupational field. This sampling test is more accurately referred to as a domain referenced test (DRT).

Advanced placement based on Comprehensive Testing (Level IV)

In some cases the admissions committee may deem a comprehensive test necessary in order to determine the skill level of a student. This examination will require the student to demonstrate skills and knowledge in every aspect of a performance area. This is the least efficient method for determining advanced placement for the student.

Student begins vo-tech training at level reflecting previous training

When advanced placement is granted -- either through acceptance of a student performance record, a structured interview, a domain referenced test or a comprehensive examination, the student may then begin the course sequence at a level which reflects the documented proficiency.

ASSESSMENT INSTRUMENTS

The previous section, narrating the steps contained in the model, emphasizes the use of a record containing a list of the competencies acquired by the student in a prior training situation. This tool, suggested for this use by the Student Assessment System Project, is called a Student Performance Record. This section of this Executive Summary Report will contain information describing how and when notations should be made on the record, who should make the notations and how to interpret the record.

The model presented student testing as an alternative to advanced placement by waiver. Therefore, this section will briefly describe how advanced placement may be made by an examination of a sampling of competencies within the occupational field, through either a structured interview or a sampling test. This sampling test is more accurately referred to as a Domain Referenced Test (DRT). A detailed explanation of how DRTs are developed may be found in the Competency Verification Guide, but an explanation of what a DRT is, how it works, and why it is used is presented in this Report.

The Student Performance Record

The student performance record used in Georgia vocational education schools will, of necessity, be a multipurpose document. A record of the student's skills and knowledge should have the capacity to go beyond articulating the student's work in a comprehensive high school cluster with only one post secondary skill area. The student performance record maintained by the high school instructor may be used to provide skill information to the specialized skill post secondary instructors or other interested individuals from all of the specific areas taught within a cluster. For

example, a health occupations teacher in a comprehensive high school should be able to certify with a single performance record, a student's acquired knowledge and skill toward becoming a dental assistant, dental lab technician, radiologic technology aide, respiratory therapy assistant, emergency medical technician, medical assistant, operating room technician, physical therapy assistant and practical nurse. In addition, the performance record may be used to inform an employer of the specific skills acquired by a student.

The Student Performance Record should reflect the core competencies which will transfer into any of the listed areas. In accomplishing this, the performance record must be based on the breadth of the high school cluster program and the depth of the post secondary program.

An accurate record keeping system is paramount if the Student Performance Record is to be successful. This record keeping system must begin with the high school vocational instructor and should follow the student's career through both the secondary school and the post secondary school. Since the Student Performance Record is based upon a task continuum, it is essential that a curricular relationship exist between secondary and post secondary programs.

In order for the post secondary student personnel worker to interpret a record of competencies submitted by the secondary school, a standardized record is necessary. This record, in an ideal situation, will list the tasks taught on both the secondary and the post secondary levels. In the sample record presented as Figure 1, the tasks EL-01 through EL-19 are taught on the secondary level and EL-20 through EL-33 are taught on the post secondary level.

Unfortunately, it will not always be feasible to list both secondary and post secondary tasks on a Student Performance Record. An example is the Record presented as Figure 2. It lists only those tasks contained in

GEORGIA VOCATIONAL EDUCATION STUDENT PERFORMANCE RECORD

ELECTRO–MECHANICAL/REFRIGERATION,HEATING and AIR CONDITIONING

Student Name _____ Social Security Number _____

Schools _____ Dates _____ Instructor(s) _____

Rating	Level of Performance
1	Degree of skill below minimum performance level
2	Acceptable level of skill; can perform with supervision and/or assistance
3	High level of skill; can perform independently and consistently at a high level

The rating on this competencey record gives the entry level vocational skills this student has demonstrated based on set standards or criteria. This record is intended for use in assessing the student's ability for employment or advanced educational purposes. An item left unmarked indicates the student has not received instruction.

The first blank indicates the secondary rating - the second blank is the post secondary rating.

MAJOR BLOCK -- Electricity (EL)

PERFORMANCE GROUP -- Fundamentals

EL-01 _ _	EL-02 _ _	EL-03 _ _
EL-04 _ _	EL-05 _ _	EL-06 _ _
EL-07 _ _	EL-08 _ _	EL-09 _ _
EL-10 _ _	EL-11 _ _	

PERFORMANCE GROUP -- Electric Motors

EL-12 _ _	EL-13 _ _	EL-14 _ _
EL-15 _ _	EL-16 _ _	EL-17 _ _
EL-18 _ _	EL-19 _ _	EL-20 _ _

PERFORMANCE GROUP -- Electrical Components

EL-21 _ _	EL-22 _ _	EL-23 _ _
EL-24 _ _	EL-25 _ _	EL-26 _ _
EL-27 _ _		

PERFORMANCE GROUP -- Controls and Installation

EL-28 _ _	EL-29 _ _	EL-30 _ _
EL-31 _ _	EL-32 _ _	EL-33 _ _

MAJOR BLOCK -- Refrigeration (REF)

PERFORMANCE GROUP -- Refrigeration Fundamentals

REF-01 _ _	REF-02 _ _	REF-03 _ _
REF-04 _ _	REF-05 _ _	REF-06 _ _
REF-07 _ _		

PERFORMANCE GROUP -- Tubing and Pipe

REF-08 _ _	REF-09 _ _	REF-10 _ _

PERFORMANCE GROUP -- Refrigerants

REF-11 _ _	REF-12 _ _	REF-13 _ _
REF-14 _ _	REF-15 _ _	REF-16 _ _
REF-17 _ _	REF-18 _ _	

PERFORMANCE GROUP -- Troubleshooting

REF-19 _ _	REF-20 _ _	REF-21 _ _
REF-22 _ _	REF-23 _ _	REF-24 _ _
REF-25 _ _		

PERFORMANCE GROUP -- Window Air Conditioning

REF-26 (AC-06) _ _	REF-27 (AC-07) _ _
REF-28 (AC-08) _ _	REF-29 (AC-09) _ _
REF-30 (AC-10) _ _	REF-31)AC-11) _ _
REF-32 (AC-12) _ _	

PERFORMANCE GROUP -- Refrigerators and Freezers

REF-33 _ _	REF-34 _ _	REF-35 _ _
REF-36 _ _	REF-37 _ _	REF-38 _ _

MAJOR BLOCK - - Residential Wiring (REW)

PERFORMANCE GROUP -- Grounded Outlets

REW-01 _ _	REW-02 _ _	REW-03 _ _
REW-04 _ _	REW-05 _ _	REW-06 _ _
REW-07 _ _		

PERFORMANCE GROUP -- Service Entrance

REW-08 _ _	REW-09 _ _	REW-10 _ _

PERFORMANCE GROUP -- Blueprint Reading

REW-11 _ _	REW-12 _ _	REW-16 _ _
REW-14 _ _		

MAJOR BLOCK -- Major Appliance (MA)

PERFORMANCE GROUP -- Installation of Appliances

MA-01 _ _	MA-02 _ _	MA-03 _ _
MA-04 _ _	MA-05 _ _	MA-06 _ _
MA-07 _ _	MA-08 _ _	MA-09 _ _

Figure 1

GEORGIA VOCATIONAL EDUCATION
STUDENT PERFORMANCE RECORD

TRANSPORTATION/AUTOMOTIVE MECHANICS

Student Name _____ Social Security Number _____

Schools _____ Dates _____ Instructor(s) _____

Rating	Level of Performance
1	Degree of skill below minimum performance level
2	Acceptable level of skill; can perform with supervision and/or assistance
3	High level of skill; can perform independently and consistently at a high level

The rating on this compentecy record gives the entry level vocational skills this student has demonstrated based on a set standards or criteria. This record is intended for use in assessing the student's ability for employment or advanced educational purposes. An item left unmarked indicates the student has not received instruction.

The first blank indicates the secondary rating, the second blank is the post-secondary rating.

MAJOR BLOCK -- Automotive Service

PERFORMANCE GROUP -- Handtools

HT-1 ___ ___ HT-2 ___ ___ HT-3 ___ ___

HT-4 ___ ___ HT-5 ___ ___ HT-6 ___ ___

PERFORMANCE GROUP -- Chassis Lubrication

CL-1 ___ ___ CL-2 ___ ___ CL-3 ___ ___

CL-4 ___ ___ CL-5 ___ ___ CL-6 ___ ___

CL-7 ___ ___

PERFORMANCE GROUP -- Servicing Coding Systems

SCS-1 ___ ___ SCS-2 ___ ___ SCS-3 ___ ___

SCS-4 ___ ___ SCS-5 ___ ___ SCS-6 ___ ___

SCS-7 ___ ___ SCS-8 ___ ___

PERFORMANCE GROUP -- Servicing Suspension Systems

SSS-1 ___ ___ SSS-2 ___ ___ SSS-3 ___ ___

SSS-4 ___ ___ SSS-5 ___ ___ SSS-6 ___ ___

SSS-7 ___ ___ SSS-8 ___ ___

MAJOR BLOCK -- Brakes

PERFORMANCE GROUP -- Hydraulic Brakes

HB-1 ___ ___ HB-2 ___ ___ HB-3 ___ ___

HB-4 ___ ___ HB-5 ___ ___ HB-6 ___ ___

HB-7 ___ ___ HB-8 ___ ___ HB-9 ___ ___

HB-10 ___ ___ HB-11 ___ ___

MAJOR BLOCK -- Engine Overhaul

PERFORMANCE GROUP -- Valve Grinding and Adjusting

VGA-1 ___ ___ VGA-2 ___ ___ VGA-3 ___ ___

VGA-4 ___ ___ VGA-5 ___ ___ VGA-6 ___ ___

VGA-7 ___ ___ VGA-8 ___ ___ VGA-9 ___ ___

VGA-10 ___ ___ VGA-11 ___ ___ VGA-12 ___ ___

Figure 2

the secondary transportation cluster curriculum materials. Therefore, a matrix linking the post secondary tasks to the secondary tasks is necessary. (See the example in Figure 3.)

To interpret the Student Performance Record, a supporting document such as Task Detailing is necessary. This document can easily show, in detail, what is taught in a task (or unit). Figure 4 is an example of what this Task Detailing document should look like. It may list the main learning concepts covered by the tasks as well as the instructional objectives upon which the unit or task is based. This is necessary since one instructor's interpretation of the learning concepts that are included in a task may be different from another instructor's interpretation.

An alternative to the above process is to print a Record which contains enough information on it to adequately inform the reader of the student's skills. This practice, in some instances, may be a practical approach. Most vocational programs, however, will not lend themselves to this approach without expanding the record to a multiple page document which would soon fill a file drawer in a permanent record keeping system.

The instructions for making notations on the student's permanent record of skill accomplishment are quite simple. The top section of the Record is self-explanatory. It provides spaces for the student's name, social security number, school name, dates of instruction and instructor name. Enough space is also provided so that both the secondary and the post secondary schools may use the same record.

The bottom portion of the record must be used in conjunction with the supporting document (Task Detailing) so that coded tasks, or units, may be interpreted. Two blanks are provided to rate the student on the accomplishment of the stated task. The first blank is meant to be utilized by the secondary instructor to keep track of the student's accomplishments.

Post Secondary	Secondary	Service station mechanic 620-261-10	Auto mechanic 620-261-10	Brake mechanic 620-281-026	Carburetor mechanic 620-281-034	Front end mechanic 620-281-038	Transmission mechanic 620-281-062	Auto mechanic helper 620-684-014	Tune-up mechanic 620-281-066
Cranking Systems (222)	**Testing Starter Motor (TSM)**								
222-1 Troubleshooting Cranking System →	TSM-1 Testing Starter Motor Resistance and Amperage Draw TSM-2 Removing and No Load Testing a Starter Motor TSM-3 Performing an Armature and Field Open and Grounded Circuit Test TSM-4 Testing Components, Assembling and Installing a Starter	X	X						X
222-2 To Overhaul Cranking Motor (Delco-Remy) 222-3 Overhauling Cranking Motor (Ford Type) 222-4 Overhauling Gear Reduction Cranking Motor (Chrysler)			X						X
222-5 Servicing Cranking System Controls		X	X						X
Basic Engine Tune-Up (223)	**Testing Engine (STE)**								
	STE-1 Calibrate the Sun Ten-Twenty Tester	X	X						
	STE-2 Making Corrections for Different Attachments on the Sun Ten-Twenty Tester	X	X						
	STE-3 Performing Engine Tests	X	X						X
	STE-4 Identifying Scope Patterns	X	X						
	STE-5 Testing Firing Patterns	X	X						
	STE-6 Using Sun Ten-Twenty Tester to Run Power Balance Test on Cylinders	X	X						
223-1 Testing Engine Internal Condition →	STE-9 Testing Engine Internal Condition		X						
223-2 Testing Cranking System		X	X						X
223-3 Testing Charging System		X	X						X
223-4 Testing Ignition System		X	X						X
	Testing Ignition Distributor (TID)								
223-5 Overhauling a Conventional Delco Remy Distributor 223-6 Overhauling a Chrysler Ignition Distributor 223-7 Overhauling a Ford Ignition System 223-8 Replacing Distributor Cap and Spark Plug Wires →	TID-1 Removing a Distributor TID-2 Testing a Distributor TID-3 Installing Points in a Distributor TID-4 Installing a Distributor TID-5 Setting the Timing	X	X						X
	Spark Plug Service (SPS)								
223-9 Cleaning or Replacing Spark Plugs →	SPS-1 Removing Spark Plugs SPS-2 Cleaning Spark Plugs SPS-3 Gapping Spark Plugs SPS-4 Testing Spark Plugs SPS-5 Testing Spark Plugs for Correct Polarity	X	X						X
	Testing Ignition Coil and Condenser (TIC)								
223-10 Testing Ignition Coil →	TIC-1 Testing Ignition Coil TIC-2 Testing the Condenser		X						
223-11 Testing Fuel Pump		X	X						
223-12 Performing On-Car Fuel System Tests and Adjustments			X						
	Testing Engines (STE) (Continued)								
223-13 Performing Tests and Servicing Emission Controls 223-14 Testing Exhaust System →	STE-7 Analyzing Exhaust with the Sun Ten-Twenty Tester STE-8 Performance Testing Engine Operation and Exhaust Emission	X	X						

Figure 3. Post Secondary/Secondary Task Matrix

TASK LIST

MAJOR BLOCK: AUTOMOTIVE SERVICE

PERFORMANCE GROUP: HANDTOOLS

HT-1 Introduction to Handtools

Objective: Given 25 of the most common handtools used in automobile repair, identify the tools. Twenty out of 25 must be correctly identified.

A. Types of handtools
B. Types of electric handtools
C. Types of air handtools
D. Safety precautions
E. Special tools
F. Securing tools and equipment

HT-2 Demonstrating Basic Handtool Use

Objective: Given 10 basic handtools used in automobile repair, demonstrate the safe and correct use of each tool.

A. Fundamentals of auto servicing
B. Tools and equipment
C. Safety precautions
D. Servicing procedure
E. Cleaning and storing equipment

HT-3 Making a Thread Block Gauge

Objective: Given specifications and the necessary tools and equipment, make a thread gauge block. All threaded holes must be at right angles to the gauge block and bolts must turn freely in each threaded hole.

A. Bolt and nut types
B. Thread sizes and classes
C. Taps and how to use
D. Dies and how to use
E. Drill motors
F. Drill bits and sharpening
G. Tap drill sizes
H. Decimal Equivalent Charts
I. Safety precautions
J. Sharpening punches and chisels
K. Making a thread gauge block
L. Securing tools and equipment

Figure 4. Task Detailing

The second blank is provided for the post secondary instructor. It is not mandatory that the post secondary instructor fill in the second blank when a task is completed, but it is recommended. A Record with notations by both the secondary and the post secondary institutions would be a very valuable document when the student begins to look for employment. The potential employer, with the use of the Task Detailing document, can see exactly what the student should know and how well the student knows it.

The Student Performance Record, by its very nature, must be a carefully controlled document. It should be looked upon in the same light as the permanent record file and should become part of that file. The performance record will, like a student's regular permanent record, have right-to-privacy stipulations. The record will not be released, just as a transcript of grades would not, without the student's permission.

Since the Student Performance Record is a controlled document, it will have limits of acceptability: (1) It must come from an unquestioned source, (2) it must be properly filled out, and (3) it must be received within a reasonable length of time from the date of the last notation. To expand these statements, a contingency plan must be developed by all post secondary schools utilizing the Student Performance Record. The contingency plan suggested is a testing program which may be utilized when, for some reason, the Record is inadequate for placement purposes or the applicant does not have credentials.

Structured Interview

The structured interview is a simple process of providing an informal oral exam, through a discussion of selected topics with the student. The interviewer, usually an instructor in the occupational area, reviews the student's performance record, or other documentation, and prepares a few

pertinent questions related to the student's area of competency. The instructor then quizzes the student to confirm the documentation of competence as presented by the student.

Domain Referenced Tests

The purpose of the Student Assessment System was to provide a method which would allow students who are entering a post secondary area vocational-technical school to bypass those skill areas in which they are already competent. With the use of creditable evidence such as the Student Performance Record and with the willingness of the receiving school to honor such a record, there is no great difficulty. In some cases, however, when the receiving school may find the documentation is questionable, incomplete, or out-of-date, another type of articulation tool such as a test is needed.

The testing procedure suggested is called Domain Referenced Testing (DRT). This procedure is designed to determine with a great deal of accuracy where to place a student within a training cycle. DRTs are formed through stratified random sampling from a universe (domain) of test items.

Domain Referenced Tests are created by using a systematic procedure for selecting samples of skills or knowledge from a job universe. Theoretically, if an instructor formulated test items from all of the possible combinations presented by a DRT Item Form Sheet (see Figures 5 and 6 for an example) the instructor would have devised a comprehensive testing situation. A comprehensive test at this point would be too expensive in terms of both student and instructor time; therefore, a sampling procedure is necessary. The DRT meets this requirement. Think of a DRT as a final test versus all of the daily tests used during one grading period.

Although DRT construction techniques will not be discussed in this document, two general requirements for test construction are presented. First, all items that could possibly appear in a DRT must be specified in

advance. Second, the items in a DRT must be selected through a random sampling process from the universe of content. Thus, a domain, the central concept of the testing procedure, is a well defined set or cluster of related tasks with the specific relationships determined through an analysis of the tasks.

The proposed testing system contains both performance and written testing. The performance component is a "hands on" test designed to evaluate the actual performance of the student, and the written component is a pool of cognitive test items designed to evaluate knowledge of the theory base in an occupation. The written test is similar to any multiple choice testing situation. The difference is that a random sample selection of the test items is used to develop the cognitive test in a given domain.

Choosing a testing situation for the skill test uses a sampling technique which is different from that used with the written test, but as an end result a testing situation representative of the performance aspects of the domain will exist. The performance test uses an Item Form Sheet (Figures 5 and 6) to aid in creating the test. The Item Form Sheet contains a description of the domain, special intructions, and spells out the Content Limits (Figure 6) of the domain. From the Content Limits, the instructor is directed to choose elements from several different facets (categories). When combined, the selected elements make a complete Domain Referenced Testing situation which covers a stratified random sample of the elements contained in the domain.

Figures 5 and 6, taken from the booklet Domain Referenced Tests, Automotive Mechanics, Volume I, Skills, are examples of an Item Form Sheet for the Heating and Cooling Systems Domain. Figure 7 is a list of tasks included in the domain. A sample test situation, which outlines the procedure for developing a DRT from the Item Form Sheet, is illustrated in Figure 8. Each DRT must have an objective evaluation device (as presented in Figure 9).

DOMAIN I: HEATING AND COOLING SYSTEMS

Item Form Sheet

Domain Statement: Diagnose present and potential problems in the heating and cooling systems of liquid cooled engines. Test, remove, and replace the faulty components.

Instructions:

1. Choose one of the customer cues provided, select a vehicle, and make sure all necessary equipment, materials and instructions are readily available.
2. Randomly select elements from appropriate facets in the Content Limits Sheet specified by customer cue selected.
3. Eliminate any repetitious elements from the test situation.
4. Carefully review all of the elements included in the test situation to be sure it represents a realistic situation. Make any needed adjustments.
5. Set up the test in such a manner that the student will be forced to diagnose and correct the problem. Upon completion the vehicle should be road ready.
6. Use the scorecard provided (and others as necessary) to determine satisfactory or unsatisfactory results.
7. Make a determination, based on the program's established standards, whether or not the student should receive advanced standing within the domain tested.

CUSTOMER CUES

Customer 1 - Tells you that the overheat warning light comes on during a hard pull.

Customer 2 - Tells you that she must constantly refill her radiator.

Customer 3 - Tells you that his heater blows cold air.

For Customer 1 choose one element from Facets E, J, L, D

For Customer 2 choose one element from Facets A, C, E, F, G

For Customer 3 choose one element from Facets D1,E, G, H, J

Figure 5

CONTENT LIMITS SHEET

(A) Pump — facets → (B) Belt

1. leak
2. defective bearing

} elements →

1. deteriorated
2. broken
3. loose

(C) Hoses

1. loose connection
2. deteriorated
3. punctured or leaking

(D) Coolant

1. low content
2. high freezing point

(E) Radiator

1. plugged
2. punctured or leaking

(F) Cap

1. bad seal
2. weak spring
3. improper pressure

(G) Heater

1. plugged
2. leaking

(H) Heater Control

1. vacuum motor stuck
2. cable broken
3. vacuum lines loose

(I) Fan

1. out of balance
2. faulty clutch
3. loose

(J) Thermostat

1. open
2. closed
3. wrong heat range
4. installed wrong

(K) System Failure Warning

1. sending unit bad
2. dash unit bad

(L) Over-Flow Tank

1. leaking
2. loose

Figure 6

I. Heating and Cooling Systems Domain Tasks

Description: Diagnose present and potential problems in the heating and cooling systems of liquid cooled engines. Test, remove, repair and replace the faulty components.

*Check coolant freezing point.
*Check coolant temperature.
*Check overflow tank.
Chemically clean and flush cooling system.
*Inspect, adjust, or replace fan belts.
Perform chemical test on cooling systems.
*Pressure test cooling system.
*Remove and replace radiators.
Replace core plugs (freeze plugs).
*Replace heater hoses.
*Replace radiator hoses.
*Replace variable speed fan.
*Replace water pump.
Solder minor leaks in radiators.
*Test and replace thermostat.
*Diagnose heating system malfunctions.
Replace defroster hose.
Replace heater control units.
Remove and replace heater core.
Repair heater core.
Service heater control components.

*DENOTES TAUGHT IN MOST SECONDARY TRANSPORTATION CLUSTER PROGRAMS.

Figure 7

SAMPLE TEST SITUATION

The following sample test situation is given to further clarify how a performance domain referenced test is constructed from a selection of test items (item pool) in the Heating and Cooling Systems Domain:

Step 1 - Customer cue number two, "Tells you that she must constantly refill her radiator," has been randomly selected.

Step 2 - A 1972 Chevelle with automatic transmission, air conditioning and power steering is the only car available.

Step 3 - Tools, test equipment, shop manuals and a service bay have been provided.

Step 4 - The following circled elements from the specified facets (on the Content Limits Sheet) have been randomly selected.

(A) Pump
(1.) leak
2. defective bearing

(E) Radiator
1. plugged
(2.) punctured or leaking

(C) Hoses
1. loose connection
(2.) deteriorated
3. punctured or leaking

(F) Cap
1. bad seal
(2.) weak spring
3. improper pressure

(G) Heater
(1.) plugged
2. leaking

Step 5 - Noting that a car with this many problems is not a realistic situation, each element is reviewed.

Step 6 - The test automobile is then "bugged" with the chosen malfunctions (leaky water pump and radiator cap with weak spring pressure). The punctured radiator, deteriorated hoses and plugged heater core are eliminated because the instructor should be able to determine, with a fair amount of accuracy, how a student would perform on these and the other tasks in the domain by how he or she performs on the tasks selected.

Step 7 - Using the scorecard, the instructor rates the student on performance as indicated. The student also rates his or her own self (neither student or instructor should be aware of the other's rating until the test is complete).

Step 8 - Using the evaluation results, and others if necessary, the instructor counsels the student and makes a decision on the student's request for advanced standing.

Figure 8

SCORECARD

Time Start _____

Time Stop _____

Major Block or Domain: _____

Objective or Domain Description:

DIRECTIONS: Score yourself from 1 to the highest possible score. Ask the instructor to do the same. You must achieve the minimum score for each criteria for successful mastery of the objective. Eliminate those indicators not deemed appropriate for the test.

PERFORMANCE INDICATORS	Std. Score	Min. Score	My Score	Instructor's Score
Proper sequencing of diagnostic steps.	10	7		
Selection of correct tools and equipment.	10	10		
Technique in use of tools and equipment.	10	8		
Time taken to pin point malfunction.	10	7		
Accuracy in locating malfunction.	10	10		
Proper removal of component part(s).	10	7		
Accuracy in determining whether to rebuild or reject a malfunctioning part.	10	10		
Accuracy in necessary component overhaul.	10	10		
Proper installation of component part(s).	10	10		
Safety performance.	10	10		
Care of tools upon completion.	10	7		
Housekeeping	10	7		
Overall quality of work.	10	7		
Time taken for complete job.	10	7		

Student Signature _____

Instructor Signature _____

Figure 9

The concept of domain referenced testing is that a successful performance based on one set of randomly selected elements within a domain provides creditable evidence to infer the ability to perform as well on a different set of elements from the same domain. Consequently, it is not necessary to test a student on every task or element within the domain in order to have confidence in the student's ability to perform well on all tasks in the domain. Of course, the more tasks or elements that are included in the test the greater the confidence in the student's ability to perform all tasks in the domain.

SUMMARY

The Student Assessment System provides a missing link in the articulation effort in Georgia; however, the challenge of articulation between secondary and post-secondary programs must still be met. In the preface to the companion documents produced by this project, three sub-processes for a successful articulation process are listed. The first is the willingness of instructors and administrators to accomplish the goals of articulation. It has been the observation of the student assessment project staff that the overall climate for articulation is positive. There are some individuals who question the wisdom of granting advanced placement based on a Student Performance Record; however, even those individuals would welcome the articulation process if they are allowed to test an incoming student's skill. The Student Assessment System provides procedures for both placement by waiver and by testing. In addition to the above, the Office of Vocational Education has aided in setting the stage for articulation with the funding of an articulation policies project.

The second sub-process which must be in place is a comprehensive articulated curriculum. This effort is underway and, in some cases, is in place. The Georgia Department of Education, Office of Vocational Education has awarded contracts in recent years for the development of self-paced, competency based, articulated curricula. In place at the present time is a curriculum for the Allied Health Occupations Cluster which is fully articulated with the Practical Nursing Curriculum, and to be released in early 1981 is the curriculum for the Electro-Mechanical Cluster which is articulated with the Refrigeration, Heating, and Air Conditioning program. An Electronics Cluster and Radio/Television Repair program is scheduled for

completion late in 1981 and a Transportation Cluster and Automotive Mechanics Program is slated for completion in 1982. In addition to these complete curriculum materials packages, the Department of Education has funded two other major efforts aimed at articulating curriculum. First, a Task Linkage Project linked the tasks taught on the secondary level with those taught on the post-secondary level. Second, The Department of Education has funded two projects designed to develop curriculum guides for 48 occupational areas taught in Georgia. These guides will also provide a means for articulation of curricula.

A functional means of student transfer is the third sub-process for the overall articulation process. This sub-process has been the major goal of the student assessment project. The products produced by this project provide the tools needed for student transfer from secondary to post-secondary vocational programs or for lateral transfer between secondary or post-secondary programs. The tools developed were:

a. The Student Assessment System
b. Student Performance Records
c. A Domain Referenced Testing program
d. An Admissions Guide
e. A generic Competency Verification Guide

Recommendations

The challenge of articulation must still be met. The Georgia Department of Education, Office of Vocational Education has made great strides toward achieving that goal, but the effort must not end with this project. It will still take much effort in the future to bring articulation to fruition.

As a process, the assessment system developed by this project will function in the future with only slight revisions and adaptive measures made by local systems. The Student Performance Records produced by the

project will serve as models for the development of performance records in occupational areas not covered in this project. The Domain Referenced Tests will, likewise, serve as a model to develop tests in other occupational areas. In addition, the Competency Verification Guide has outlined step-by-step procedures for development of Performance Records and DRTs.

Development of assessment techniques and procedures in other areas will still be a very difficult task. For this reason, the following recommendations are presented:

1. All future curriculum materials development or revision projects should contain, as a standard specification and requirement, the development of Domain Referenced Tests for both skills and theory and the development of a Student Performance Record (and supporting document if necessary).

2. Occupational areas which are not scheduled for revision or development of curriculum materials in the near future should be provided with assistance from the Georgia Department of Education, Office of Vocational Education. This assistance can come in the form of an Educational Consultant to work with Local Education Agencies to develop assessment products, or it can be in the form of additional funded projects to develop assessment products.

The developmental process undertaken by the project staff required extensive personal contact with Vocational Education leadership personnel in Georgia. From these contacts, other recommendations concerning the system and the products of the project are made:

1. The Student Performance Record could be one of the best public relations tools a school (secondary or post secondary) can have. The primary purpose of the record is to serve as a transcript of skills to be sent from the secondary school to the post-secondary school. However, the record can be used to inform parents, employers, business leaders and significant others exactly what is taught in the vocational school. Those community members who may employ the vocational graduate can be made aware of what to look for in the form of a skills record for an applicant. The record will tell the employer what the applicant should know and how well the applicant knows it. An additional advantage is that the school and the employer must get together to talk about what is contained in the curriculum, what it lacks and how it could be improved. These are functions craft advisory committees have traditionally performed and should continue to perform in the

future. The advantage being pointed to is an additional opportunity for communication between school, work, and home.

2. In the post-Viet Nam era, individuals receiving veterans' benefits were predominant in Georgia's post secondary vocational schools. However, these numbers are declining and will continue to decline due to changes in veterans' benefits offered by the armed services and changes brought about by the advent of the "All Volunteer Army" (America's armed force since the end of the Viet Nam era draft). For these and other reasons (the waning years of the baby boom), some AVTS schools in Georgia have experienced a decline in enrollment in recent years. To continue to serve all of those who need their assistance, in the most efficient fashion, it is recommended that the AVTS use the articulation process to attract students with some previous preparation.

DEFINITION OF TERMS

This project includes, by necessity, certain terms peculiar to the subject under consideration. These terms are identified as follows.

Content Limits - The boundaries of a domain that identifies the allowable content of a Domain Referenced Test (DRT). Usually grouped into facets and elements of the facets. Identifies the allowable content of a DRT.

Competency - The ability (knowledge, skills and attitudes) to perform all of a group or cluster of related tasks required to complete a designated activity according to occupational standards. In the educational setting the statement of a competency includes expected student outcomes in terms of knowledge, skills and attitudes required to complete a designated activity as defined by incumbent workers according to the standards of the work place.

Comprehensive Examination - An examination which includes test items for each element of knowledge and/or skill in a specified area to be tested.

Domain - A well-defined set or cluster of related tasks. Specific relationships are determined through an analysis of the tasks.

Domain Referenced Test (DRT) - A test developed from a stratified random selection of test elements.

Domain Statement (Description) - A general descriptive statement that identifies the behavior and the content upon which the test may focus.

Duty - A group of related tasks which constitute a standardized part of a whole job (worker responsibility, unique use of equipment or machinery and specific system designs).

Elements - Variable components (alternatives) of the facets used to form test items. One or more elements from separate facets may be combined to form a test item.

Facets - Characteristics on which domain test items may differ. Facets are made up of groups of related but variable components which are called elements.

Item Form Sheet - A list of rules for generating a set of related test items. (Hively, 1974). An Item Form Sheet includes the instruction or rules for forming a test item and the limits of the content of the test item.

Job - A specific area of specialization within an occupational field consisting of several closely related duties for which a person would expect to receive remuneration. Should be identified by DOT code.

Structured Interview - An oral examination of a student's ability administered by the instructor and developed from content that has been previously identified and delimited by domain.

Task - The smallest division of work in which a measurable output occurs. A logical and necessary step in the performance of a duty.

Test Item - A statement of a situation or a question designed to evoke a specific response or set of responses. The responses may be verbal, written, psychomotor or a combination of response types.

Test Item Pool - A list or group of test items related to a specified area of knowledge and/or skill to be tested.

Waiver - The act of allowing students to bypass instructional units in which they have demonstrated previously acquired knowledge and/or skill.

Federal law prohibits discrimination on the basis of race, color or national origin (Title VI of the Civil Rights Act of 1964); sex (Title IX of the Educational Amendments of 1972 and Title II of the Vocational Education Amendments of 1976); or handicap (Section 504 of the Rehabilitation Act of 1973) in educational programs or activities receiving federal financial assistance.

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The following individuals have been designated as the employees responsible for coordinating the department's effort to implement this nondiscriminatory policy.

Title II - Loydia Webber, Vocational Equity Coordinator
Title VI - Peyton Williams Jr., Associate Superintendent of State Schools and Special Services
Title IX - Evelyn Rowe and Myra Tolbert, Coordinators
Section 504 - Jane Lee, Coordinator of Special Education

Inquiries concerning the application of Title II, Title VI, Title IX or Section 504 to the policies and practices of the department may be addressed to the persons listed above at the Georgia Department of Education, State Office Building, Atlanta 30334; to the Regional Office for Civil Rights, Atlanta 30323; or to the Director, Office for Civil Rights, Education Department, Washington, D.C. 20201.